Consumer and Corporate Affairs Canada

Consommation et Corporations Canada

(11) (A) No. 1 192 015

(45) ISSUED 850820

(52) CLASS 20-45

(51) INT. CL. $^{4}$ E04C 3/08,3/32

# (19) (CA) CANADIAN PATENT (12)

(54) Load Bearing Thermal Steel Stud

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(21) APPLICATION No. 409,198

(22) FILED 820811

(30) PRIORITY DATE U.S.A. (292,313) 810812

No. OF CLAIMS 8

Canada

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CCA-274 (11-82)

# ELONGATED METAL STRUCTURAL MEMBERS

## Field of the Invention

The present invention relates to elongated metal structural members and in particular to such members for use as studs in the framework of buildings.

## Review of the Prior Art

It is of course extremely well known to construct walls of a building by use of elongated vertical studs to which are attached facing materials, such as plasterboard, particle board, siding, etc. Such studs also provide support for window frames and door casings and establish a cavity within which thermal insulation may be located. The demand for load bearing steel studs is growing, and in institutional, commercial and industrial buildings, where steel studs are already in use, the market share is growing due to the non-flammability of the studs. In the residential market, the increase in cost of wood and above all, the dimensional stability of steel, has also increased the marketability of such studs. Steel studs usually are formed from sheet material which is roll formed or otherwise bent to provide a C cross-section. A problem with such studs however, is that the metal has a much higher thermal conductivity than wood, and generally they have permitted a greater heat flow from one surface to the other than the equivalent wood stud. In order to reduce thermal conductivity as much as possible, and also to reduce the cost and weight of the steel studs, they are made from the thinnest possible material that will provide the required structural strength, and any reduction in thickness that is possible is

highly desirable.

Definition of the Invention

It is therefore an object of the present invention to provide a metal structural member which thermal conductivity is reduced whilst retaining the required structural strength.

According to the present invention there is provided an elongated metal stud member roll-formed from an elongated metal strip of uniform thickness comprising:

two spaced flange members extending generally parallel to the longitudinal axis of the elongated member and to one another and interconnected by a transverse web member integral with said two spaced flange members;

said web member comprising a plurality of coplanar straps traversing said longitudinal axis and inclined thereto to define a plurality of apertures;

each of said straps having a pair of upturned edges projecting out of the plane of said web at the perimeter of the respective apertures, thereby providing a channel of generally U-shaped cross-section to increase the rigidity of the strap, each of said strap edges varying in height along the length of the respective strap, and being of maximum height at a point located approximately midway between said flange members; and

said stud member elements being of the same uniform thickness and requiring a minimal amount of metal to minimise thermal transmissivity while providing structural strength.



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The use of straps having the defined channel cross-section permits them to be thinner so that the heat flow between the two flange members is reduced whilst retaining the rigidity of the stud. The variation in height of the lips of the strap, with the maximum height at a point located approximately midway between the flanges, increases the rigidity of the web.

Description of the Drawings

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

FIGURE 1 is a perspective view of a portion of a structural stud;

FIGURE 2 is a side elevation of the stud of Figure 1;

FIGURE 3 is a cross-section on the line 3-3 of Figure 2, showing surfacing material connected to one flange of the stud;

FIGURE 4 is a plan view similar to Figure 2 of a blank from which the member is formed, as it appears prior to the step in which the web member is finally formed;

FIGURE 5 is an end view showing a pair of the studs shown in Figure 1 nested together to provide a composite stud; and

FIGURE 6 is a view similar to Figure 2 of an alternative embodiment of the stud shown in Figure 1.

Referring now to the drawings, an elongated metal structural stud 10 is formed to have a pair of spaced parallel flange members or portions 12 and 14 respectively interconnected by a transverse web member or portion 16. The web member 16 is formed with a plurality of triangular-shaped apertures 18 which alternate in their direction of extension, and so that each immediately adjacent pair of apertures borders an intervening strap 20, resulting in a plurality of such straps 20 which traverse the longitudinal axis indicated by LL in Figure 2 of the stud 10 and are inclined to the axis. It will be seen that adjacent pairs of the straps 20 converge toward one another to define with a cooperating one of

the flange portions at their other ends the respective generally triangular aperture 18 in the web portion 16.

Each of the straps 20 is bordered by a pair of upturned edges 22 which project therefrom perpendicular to the plane of the web portion 16, so that each of the straps has a generally U-shaped channel cross-section. The height of the edges 22 varies progressively along the length of the straps 20 from each end to a maximum at a point 24 approximately midway between the flange portions 12 and 14. Each two immediately adjacent converging straps merge smoothly together at their junction at the apex of the respective aperture 18 while their opposite ends have between them an elongated edge portion 26 parallel to the flange portions. The edges 22 of adjacent converging straps 20 merge smoothly with one another at the respective end where the straps 20 converge, while the respective edges 22 are interconnected at their other ends by inturned edges 28 extending from the respective elongate edge portions 26 of the web member 16.

Each edge portion 26 is connected to an inner perpendicular planar portion 30, which forms part of the respective flange portion 12 and 14. Respective outer perpendicular planar portions 32 extend generally parallel to the respective inner planar perpendicular portions 30 but are spaced therefrom and connected thereto by respective planar parallel members 34, the members 34 extending generally parallel to the plane of the web 16 but laterally spaced therefrom. An inwardly directed edge portion or member 36 is formed at the opposite end of each of the outer planar perpendicular portions 32, and serves to increase the

rigidity of the respective outer planar perpendicular member.

The outer planar perpendicular member 32 of the flange portion 12 has a greater width than the corresponding planar perpendicular member of the flange portion 14; the web portion 16 is positioned to one side of a plane containing the mid-points of the two planar perpendicular members 32 with the maximum height of the lip 22 at the point 24 extending to this plane. This greater width of flange portion 12 is such that flange portion 14 will fit snugly within flange portion 12, as shown in Figure 5, when two studs are turned end-for-end. The inwardly directed edge portions 36 are therefore offset as are the planar parallel members 34. This enables a pair of studs 10 to be nested as shown in Figure 5 to form a composite stud. The resulting composite stud is symmetrical about the last-mentioned plane and provides a very rigid structural member. The studs 10 however can be used individually as is shown in Figures 2 and 3. It will be noted that each flange includes a stepped portion constituted by connected portions 26 and 30. Each flange cross-section comprising portions 30, 32 and 36 has a considerable moment of inertia about the major axis, and this moment is further increased by the presence of the stepped portion. This effect is particularly important at the end of a stud which can therefore be cut to any random length. In addition the fact that the plane of the web 16 is closer to the central line than in a C cross-section stud makes the stud more symmetric about the central line and less prone to rotate under lateral loads, such as wind loads. The outer surface of the outer perpendicular member 32 provides a support surface for facing material, such as panels 38

(Fig. 3) which may be secured to the surface by self-tapping screws, indicated at 40. Facing material can also be attached to the corresponding surface of the other perpendicular portion 32 to provide a cavity wall installation. The provision of the apertures 18 in the web reduces the heat transmission between the flanges 12 and 14, whilst the provision of the edges 22 on the straps 20 ensures adequate rigidity and strength for the web portion 16. The shape of the edges 22 ensures that they employ the minimum of metal, while providing rigidity at the location where it is specifically needed. It has been found that a web portion formed in this manner is more rigid than, for example, a web provided with a plurality of spaced longitudinally extending slots. The planar parallel portions 34 will also provide support surfaces for window and door frames or the like, so that the stud may be used with conventional construction techniques.

A preferred method of production of the metal structural members of the invention is by roll forming, a blank of the shape illustrated by Figure 4 being first produced and thereafter the edges 22 being turned by a drawing operation. Thus, apertures 18 are punched from the blank after the flange portions 12 and 14 have been roll formed, the blank being cut so that the edges 22 and 28 are continuous, the inner limits of the edges being shown in broken lines in Figure 4. The tapering of the edges 22 from the points 24 towards the opposite ends of the straps 18 reduces the deformation of material as the edges 22 are drawn to the position shown in Figures 2 and 3, and thereby reduces the possibility of splitting of the material. It has also been found that the provision of the

edges 28 enhances the rigidity of the stud even if it is cut directly through an aperture 18. This again increases the utility of the stud and makes it sufficiently versatile to be used on a conventional construction site.

An alternative embodiment of the stud is shown in Figure 6 in which the straps 20 are spaced further apart so that the apertures 18 are generally trapezoidal in shape, the location of the triangular apertures of the previously-described embodiments being whown in broken lines for comparison. This further reduces the transmission of heat through the stud but still maintains the structural strength required for general construction purposes.

It will be seen therefore that a longitudinal structure member has been provided which can readily be formed from sheet material and in which the transmission of heat between the flanges thereof is reduced whilst the overall rigidity of the member is maintained.



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